

**REMARKS**

Claims 1-4 are presently pending in the captioned application with claim 1 being currently amended.

Claim 1 has been amended to recite that the occupying volume decreases from the starting gas inlet side toward the outlet side. Support for the amendment can be found in Examples 1-4 of the specification at page 14, lines 15-16, 26-27 and 30; page 15, line 1; and page 17, lines 3-5.

In particular, Example 1 teaches a filled stainless reactor being packed from the inlet to the outlet side with a first catalyst having an occupying volume of  $573 \text{ mm}^3$  (Catalyst 2) and a second catalyst having an occupying volume of  $170 \text{ mm}^3$  (Catalyst 1). Similarly, Example 4 teaches a first catalyst packed starting from the inlet side having an occupying volume of  $573 \text{ mm}^3$  (Catalyst 2), a second catalyst having an occupying volume of  $289 \text{ mm}^3$  (Catalyst 6), and a third catalyst having an occupying volume of  $170 \text{ mm}^3$  (Catalyst 1). The Examples 2-3 show similar decreasing packing arrangement of occupying volumes.

No new matter within the meaning of § 132 has been added by the amendment.

Accordingly, Applicant respectfully requests the Examiner to

enter the amendment, reconsider and withdraw the outstanding rejections and allow all claims as presently pending in the captioned application.

**1. Rejection of Claim 1 under  
35 U.S.C. § 112, 1<sup>st</sup> paragraph**

The Office Action maintains the rejection of claim 1 under 35 U.S.C. § 112, 1<sup>st</sup> paragraph. Despite Applicant's very thorough traversal of the rejection in the previously filed Response of August 21, 2003, the Office Action very tersely maintains the rejection because:

The rejection of claim 1 has been maintained due to applicants' failure to modify in the amendment.

Applicant does not understand this statement given that no amendment was proffered or even discussed and further because an amendment to the claims is not required to traverse a rejection under § 112, ¶ 1.

Again, Applicant notes that a very detailed and well reasoned argument was provided in the previously filed Response of August 21, 2003, and now provides it again for careful re-consideration by the Examiner.

Reviewing the facts, it is noted that the Office Action of May

21, 2003, first rejected claim 1 under § 112, ¶ 1 because the specification allegedly failed to reasonably enable one of ordinary skill to make the presently claimed catalysts. The Office Action stated:

The specification does not enable a person skilled in the art to which it pertains, or with which it is most nearly connected, to include all the catalysts unrelated to the invention commensurate in scope with these claims. Furthermore, the instant specification fails to provide information that would allow the skilled artisan to practice the instant invention without undue experimentation. Attention is directed to *In re Wands*, 8 USPQ2d 1400 (CAFC 1988) at 1404 where the court set forth the eight factors to consider when assessing if a disclosure would have required undue experimentation, citing *Ex Parte Forman*, 230 USPQ 546 (BdApls 1986) at 547 the court recited eight factors:

- 1) the quantity of experimentation necessary.
- 2) the amount of direction or guidance provided,
- 3) the presence or absence of working examples,
- 4) the nature of the invention,
- 5) the state of the prior art,
- 6) the relative skill of those in the art,
- 7) the predictability of the art, and
- 8) the breadth of the claims.

In the instant case, the claim encompasses a number of multi-combined catalysts. However, applicants' specification provide only 6 particular exemplified catalyst compounds shown in the specification (see pages 9-13). Furthermore, the catalyst compositions represent an unpredictable aspect in the art of organic chemistry. See *Exparte Sizto*, 9 USPQ2d 2081 (Bd. Of App. And Inter. March

1988). Thus, the specification herein has failed to provide sufficient working examples to support the use of numerous combinational catalysts. Therefore, an appropriate correction is required.

Applicant then respectfully traversed the rejection in the previous Response of August 21, 2003, and argued that one of ordinary skill in the art would have been able to practice the presently claimed invention without undue experimentation. The arguments are reproduced here again for careful consideration by the Examiner.

In particular, it is argued that Referential Examples 1-6 along with the disclosure in the specification sufficiently enables one of ordinary skill in the art to make the plural catalysts of claim 1 as presently claimed. Moreover, the unpredictability of catalyst compositions are rendered predictable in the present case by the precise and detailed description provided for the process of producing as well as the compositional make-up of the presently claimed plural catalysts.

In particular, the first paragraph of 35 U.S.C. § 112 requires that the "specification shall contain a written description of the invention . . ." To satisfy the requirement, the specification must describe the claimed invention in sufficient detail that one skilled in the art can reasonably conclude that the inventor had

possession of the claimed invention. Vas-Cath, Inc. v. Mahurkar, 935 F.2d 1550, 1563, 19 USPQ2d 1111, 1116 (Fed. Cir. 1991). Moreover, a description as filed is presumed to be adequate, unless the examiner presents sufficient evidence or reasoning to rebut the presumption. See e.g., In re Marzocchi, 439 F.2d 220, 224, 169 USPQ 367, 370 (CCPA 1971).

The examiner, therefore, must have a reasonable basis to challenge the adequacy of the written description wherein the examiner has the initial burden of proving why a person skilled in the art would not recognize a description of the invention defined by the claims. See In re Wertheim, 541 F.2d at 263-64, 191 USPQ at 97; "Guidelines for the Examination of Patent Application Under the 35 U.S.C. 112, §1, "Written Description" Requirement" Federal Register, Vol. 66, No. 4, (Friday, January 5, 2001).

Turning to the *prima facie* case, Applicant respectfully submits that the Office Action has failed to satisfy the burden insofar as the Office Action fails to provide a reasonable basis why a person skilled in the art would not be able to make the plural catalysts as claimed in view of the disclosure and Referential Examples 1-6. In particular, the unpredictable aspect of catalyst compositions within the art of organic chemistry is not applicable in the present situation because Applicant has sufficiently described the invention through the Referential

Examples 1-6 and disclosure such that one of ordinary skill would have been enabled to make the presently claimed plural catalysts without undue experimentation.

Moreover, one of ordinary skill in the art would have reasonably concluded that Applicant had possession of the claimed plural catalysts because Applicant provides the process of making as well an extremely detailed description of the catalysts. For example, Applicant states that the plural catalysts have the general formula (1)  $\text{Mo}_a\text{W}_b\text{Bi}_c\text{Fe}_d\text{A}_e\text{B}_f\text{C}_g\text{D}_h\text{E}_i\text{O}_x$  wherein Mo is molybdenum; W is tungsten; Bi is bismuth; Fe is iron; A is at least an element selected from cobalt and nickel; B is at least an element selected from phosphorus, tellurium, arsenic, boron, antimony, tin, cerium, niobium, lead, chromium, manganese and zinc; C is at least an element selected from alkali metal elements; D is at least an element selected from alkaline earth metal elements; E is at least an element selected from silicon, aluminum, titanium and zirconium; and O is oxygen; a, b, c, d, e, f, g, h, i and x denote the atomic numbers of Mo, W, Bi, Fe, A, B, C, D, E and O, respectively, and where a is 12, b is 0-5, c is 0.1-10, d is 0.1-10, e is 1-20, f is 0-5, g is 0.001-3, h is 0-3, i is 0-30, and x is a numerical value which is determined depending on the extent of oxidation of each of the elements.

Given such extreme detail as to the character and type of the

plural catalysts of the present invention, it can hardly be said that the claimed plural catalysts rise to the level of unpredictability contemplated by Ex parte Sizto. 9 USPQ2d 2081 (Bd. Of App. And Inter. March 1988). One of ordinary skill in the art based on the amount of direction provided by the specification as to the preparation of the plural catalysts along with the working examples (Referential Examples 1-16) and still further in view of the state of the art as well as predictability of catalysts in view of the detailed claim limitations would have been able to make the claimed invention without undue experimentation.

Accordingly, Applicant again respectfully requests the Examiner to carefully consider the re-stated arguments and reconsider and withdraw the rejection to claim 1 under § 112, 1<sup>st</sup> paragraph.

**2. Rejection of Claims 1-4**  
**under 35 U.S.C. § 103(a)**

The Final Office Action maintains the rejection of claims 1-4 as being unpatentable under 35 U.S.C. § 103(a) over WO 98/24746 ("Wada et al.") which is equivalent to U.S. 6,028,220 ("Wada et al."). The Final Office Action states:

First, with regard to the first and third

arguments [of the Response of August 21, 2003], the Examiner has noted applicant's argument. However, the reference does indicate that the powder containing catalytically active components is subjected to preliminary calcinations at a temperature of from 300 to 500°C. (see col. 5, lines 40-42); also, the activities of a plurality of catalysts **are controlled by changing composition of catalytically active components (kind and/or quantity of an alkali metal in particular) are packed in the reaction tube (see from col. 1, line 66 to col. 2, line 2).**

Furthermore, with respect to the **occupying volume, this is well understood by those of ordinary skill in the art to be a result-effective variable**, especially when attempting to control selectivity of a chemical process. Therefore, it would have been obvious to the skilled artisan in the art to have motivated to adjust the Wada's et al. occupying volumes by routine experimentations in order to obtain the optimum ranges for the catalytic activity for the plurality of catalysts. This is because the skilled artisan would expect to increase the catalytic activity for the plurality of catalysts by the manipulation of the occupying volume. Therefore, the reference does teach those limitations.

Applicant traverses the rejection because Wada et al. does not teach each and every claimed limitation of amended claim 1. In particular, Wada et al. fails to teach or provide any motivation to make the presently claimed limitation that the occupying volume **decreases** from the starting gas inlet side toward the outlet side. Instead, Wada et al. specifically teaches away from such a teaching



and discloses that a reaction tube should be filled with catalysts in such a manner that the occupying volume **increases** from the starting gas inlet side toward the outlet side or does not change at all. See "Oxidation Reaction" in Examples 1, 2, 3 and 5 of Wada et al.

Although the Office Action asserts that varying the occupying volume is well understood by those of ordinary skill in the art, the conflicting prior art as well as Wada et al. own opposite teaching that occupying volume should increase towards the outlet side demonstrates that occupying volume is not a results-effective variable subject to routine optimization. As noted numerous times, reducing hot spots in the catalyst layer to prevent run-away reactions during acrolein production is a non-trivial exercise that requires a great deal of inventive effort.

Turning to a rule statement, the Federal Circuit held that a *prima facie* case of obviousness must establish: (1) some suggestion or motivation to modify the references; (2) a reasonable expectation of success; and (3) that the prior art references teach or suggest all claim limitations. Amgen, Inc. v. Chugai Pharm. Co., 18 USPQ2d 1016, 1023 (Fed. Cir. 1991); In re Fine, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988); In re Wilson, 165 USPQ 494, 496 (C.C.P.A. 1970).

In the present application, amended claim 1 recites a process for producing acrolein and acrylic acid, comprising molded catalysts which are formed of complex oxides of the composition expressed by a general formula (1):



wherein the plural kinds of catalysts are different from each other in

( $\alpha$ ) occupying volume, and

( $\beta$ ) calcining temperature and/or

( $\gamma$ ) kind and/or amount of the alkali metal element,

**wherein the occupying volume ( $\alpha$ ) decreases from the starting gas inlet side toward the outlet side.**

However, Wada et al. fails to teach the presently claimed limitation that the occupying volume ( $\alpha$ ) decreases from the starting gas inlet side toward the outlet side.

For example, Wada et al. teaches reaction tubes filled with catalysts wherein the occupying volume either increases from the starting gas inlet side toward the outlet side or does not change. See "Oxidation Reaction" in Examples 1, 2, 3 and 5 of Wada et al. In particular, Example 1 of Wada et al. teaches an inlet side filled with a Catalyst (1) having a particle size of 4.0 mm (equivalent to an occupying volume of  $4.0^3 \text{ mm}^3$ ), and outlet side

being filled with a Catalyst (2) having a particle size of 4.1 mm (equivalent to an occupying volume of  $4.1^3 \text{ mm}^3$ ). See Wada et al. at col. 9, lines 49-50 and col. 10, lines 3-4.

In the "Oxidation Reaction" of Example 5 of Wada et al., the inlet side is filled with a Catalyst (7) having a particle size of 4.5 mm (equivalent to an occupying volume of  $4.5^3 \text{ mm}^3$ ), and outlet side filled with a Catalyst (6) also having a particle size of 4.5 mm (equivalent to an occupying volume of  $4.5^3 \text{ mm}^3$ ). See Wada et al. at col. 12, line 34 and col. 11, line 45.

In contrast, the Examples 1-4 of the present invention specifically recite that the occupying volume decreases from the inlet side to the outlet side. Example 1 of the present invention teaches that the inlet side is filled with a Catalyst (2) having an occupying volume of  $573 \text{ mm}^3$ , and the outlet side being filled with a Catalyst (1) having an occupying volume of  $170 \text{ mm}^3$ . Filling the reaction tubes in such a manner unexpectedly reduces the occurrence of hot-spots as shown by the following Table 1:

Table 1

	Filled catalyst		Occupying Volume ( $\text{mm}^3$ )		Reaction Time (h)	Reaction temperature ( $^{\circ}\text{C}$ )	Propylene Conversion (mol%)	One pass yield of acrolein+ acrylic acid (mol%)
	Inlet side	Outlet side	Inlet side	Outlet side				
Example 1	Catalyst (2)	Catalyst (1)	573	170	Initial period	305	98.1	94.4
					8000	320	98.3	94.9
Comparative Example 1	Catalyst (5)	Catalyst (1)	170	170	Initial period	307	97.9	93.9
					8000	345	97.1	92.1

In particular, Comparative Example 1 corresponds to "Oxidation Reaction" of Example 5 of Wada et al. But as shown by the Table 1, when the occupying volume ( $170 \text{ mm}^3$ ) of the outlet side is the same as the occupying volume ( $170 \text{ mm}^3$ ) of the inlet side, the reaction temperature is significantly higher and the yield is markedly lower. For large scale industrial production, these differences in reaction temperature and yield translate into huge savings that are clear indications of commercial success and hence, non-obviousness.

Although the Office Action maintains that occupying volume is a results-effective variable well understood by those of ordinary skill in the art, the conflicting prior art as well as Wada et al. own opposite teaching that occupying volume should increase towards the outlet side demonstrates that occupying volume is not a results-effective variable subject to routine optimization.

In particular, Wada et al. discusses Japanese Patent Application Kokai No. 4-217932 (1992) at col. 4, lines 54-67, which teaches a larger occupying ratio at the inlet side. However, Wada et al. specifically states that their invention is "quite contrary to the method of the prior art".

Moreover, Wada et al. teaches away from reaction tube packed in such a manner. Wada et al. specifically teaches that making the occupying volume small toward its outlet side from the inlet side should be avoided because the ratio of occupying volumes of

adjacent two reaction zones must be controlled within a specified range and because further complex operations regarding shape and composition and other factors of the catalysts are required. In other words, Wada et al. fails to provide any suggestion or motivation to make the presently claimed limitation.

In contrast, the presently claimed limitations relate to a synergistic combination of ( $\alpha$ ) "the change of occupying volume", ( $\beta$ ) "the change of calcining temperature" and/or ( $\gamma$ ) "the change of kind and/or quantity of alkali metal", which unexpectedly result in reduction of hot spots and therefore improved acrolein and acrylic acid production. As noted numerous times, reducing hot spots in order to prevent run-away reactions or unwanted oxidation during acrolein production is a non-trivial exercise that requires a great deal of inventive effort to solve. Clearly, a *prima facie* case of obviousness has not been established because each and every claimed limitation has not been taught or suggested by the cited reference.


Accordingly, Applicant respectfully submits that the presently claimed invention is not obvious over Wada et al. and respectfully requests the Examiner to reconsider and withdraw the § 103(a) rejection of claims 1-4.

**CONCLUSION**

In light of the foregoing, Applicant submits that the application is now in condition for allowance. The Examiner is therefore respectfully requested to reconsider and withdraw the rejection of the pending claims and allow the pending claims. Favorable action with an early allowance of the claims pending is earnestly solicited.

Respectfully submitted,

**SHERMAN AND SHALLOWAY**

  
\_\_\_\_\_  
Attorney for Applicants  
Roger C. Hahn  
Reg. No. 46,376

**SHERMAN AND SHALLOWAY**  
413 N. Washington Street  
Alexandria, Virginia 22314  
703-549-2282



Attorney Docket No. S-2482  
MAIL STOP RCE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

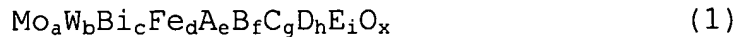
In re Application of: ) Group Art Unit: 1625  
TANIMOTO ) Examiner: OH, TAYLOR V.  
Serial No. 09/778,747 )  
Filed: February 08, 2001 )  
For: **PROCESS FOR PRODUCING ACROLEIN AND ACRYLIC ACID**

**RECEIVED**  
**MAR 09 2004**

Appendix A

Please amend the claims according to 37 C.F.R. § 1.121 concerning a manner for making claim amendments.

1. (Currently Amended) A process for producing acrolein and acrylic acid through vapor phase catalytic oxidation of propylene with molecular oxygen or molecular oxygen-containing gas using a fixed bed shell-and-tube reactor, which comprises preparing plural kinds of molded catalysts which are formed of complex oxides of the composition expressed by a general formula (1):



(wherein Mo is molybdenum; W is tungsten; Bi is bismuth; Fe is iron; A is at least an element selected from cobalt and nickel; B is at least an element selected from phosphorus,

tellurium, arsenic, boron, antimony, tin, cerium, niobium, lead, chromium, manganese and zinc; C is at least an element selected from alkali metal elements; D is at least an element selected from alkaline earth metal elements; E is at least an element selected from silicon, aluminum, titanium and zirconium; and O is oxygen; a, b, c, d, e, f, g, h, i and x denote the atomic numbers of Mo, W, Bi, Fe, A, B, C, D, E and O, respectively, and where a is 12, b is 0-5, c is 0.1-10, d is 0.1-10, e is 1-20, f is 0-5, g is 0.001-3, h is 0-3, i is 0-30, and x is a numerical value which is determined depending on the extent of oxidation of each of the elements)

and which are different from each other in

( $\alpha$ ) occupying volume, and

( $\beta$ ) calcining temperature and/or

( $\gamma$ ) kind and/or amount of the alkali metal element,

the molded catalysts which are different from each other in occupying volume ( $\alpha$ ) being prepared by varying the dimensions of catalyst particles within the range of 3-15 mm,

the molded catalysts which are different from each other in calcining temperature being prepared by varying



the final calcining temperature ( $\beta$ ) within the range of 300-650°C, and

the molded catalysts which are different from each other in amount of the alkali metal element ( $\gamma$ ) being prepared by varying the atomic number  $g$  in the general formula (I) within the range of 0.001-3, and

filling the reaction zones provided by dividing the catalyst layer in each of the reaction tubes in the fixed bed shell-and-tube reactor into at least two layers in the axial direction of the tube, sequentially with said plural kinds of molded catalysts in such a manner that the catalytic activity increases from the starting gas inlet side toward the outlet side and the occupying volume decreases from the starting gas inlet side toward the outlet side.

2. (Original) A process according to Claim 1, in which the number of reaction zones is 2 or 3.

3. (Previously amended) A process according to Claim 1, in which a starting gas whose propylene concentration is at least 9 volume % is introduced.

4. (Previously added) A process according to Claim 2, in which a starting gas whose propylene concentration is at least 9 volume % is introduced.